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V. Solution by A. H. HOLMES, Brunswick, Maine.

$$x^2 + (x+1)^2 = \square \text{ or } 2x^2 + 2x + 1 = \square. \text{ Let } x=y+p.$$

$\therefore 2y^2 + (4p+2)y + 2p^2 + 2p + 1 = \square$, from which we find the law of the series to be: $b=1+3a+2\sqrt{2a^2+2a+1}$. Let $a=3$ and we find $b=20$. Then by the same law, $c=119$, $d=696$, $e=4059$, and $f=23660$. Therefore, we have for the first six sets of values: (3 and 4), (20 and 21), (119, 120), (696 and 697), (4059 and 4060), and (23660 and 23661).

VI. Solution by H. C. WILKES, Skull Run, West Virginia.

We have $x^2 + (x+1)^2 = y^2 = 4n+1$, then $x(x+1)/2 = n$. Substituting this value for n in $4n+1=y^2$ we have $x^2 + x = (y^2 - 1)/2$. Putting $x + (x+1) = t$ or $x = (t-1)/2$, we obtain $t^2 - 2y^2 = -1$. Since $t=7$, $y=5$ satisfy this equation, the first values of $x + (x+1)$ and y will be 7 and 5.

$\therefore 3^2 + 4^2 = 5^2$. From inspection of solution II, Problem 36, Vol. III, page 81, we find a formula for obtaining the succeeding values of $x + (x+1)$ and y .

$x + (x+1)$.	y .	
$6 \times 7 - 1 = 41$,	$6 \times 5 - 1 = 29$,	$20^2 + 21^2 = 29^2$,
$6 \times 41 - 7 = 239$,	$6 \times 29 - 5 = 169$,	$119^2 + 120^2 = 169^2$,
$6 \times 239 - 41 = 1393$,	$6 \times 169 - 29 = 985$,	$696^2 + 697^2 = 985^2$,
$6 \times 1393 - 239 = 8119$,	$6 \times 985 - 169 = 5741$,	$4059^2 + 4060^2 = 5741^2$,
$6 \times 8119 - 2392 = 47321$.	$6 \times 5741 - 985 = 33461$.	$23660^2 + 23661^2 = 33461^2$.

Also solved by J. SCHEFFER and G. B. M. ZERR.

48. Proposed by B. F. YANNEY, A. M., Professor of Mathematics in Mount Union College, Alliance, O.

If any positive integral number N be divided by another positive integral number D , leaving a remainder 1, then any positive integral power of N , divided by D , will leave a remainder of 1.

I. Solution by ARTEMAS MARTIN, LL. D., U. S. Coast and Geodetic Survey Office, Washington, D. C.

Let $N = nD + 1$, then

$$\begin{aligned}
 (nD + 1)^m &= n^m D^m + mn^{m-1} D^{m-1} + \frac{m(m-1)}{2} n^{m-2} D^{m-2} + \\
 &\quad \dots + \frac{m(m-1)}{2} n^2 D^2 + mnD + 1, \\
 &= D[n^m D^{m-1} + mn^{m-1} D^{m-2} + \frac{m(m-1)}{2} n^{m-2} D^{m-3} + \dots + \frac{m(m-1)}{2} n^2 D + mn] + 1,
 \end{aligned}$$

which proves the proposition.

Solved in a similar manner by M. A. GRUBER and G. B. M. ZERR.

II. Solution by J. C. CORBIN, Pine Bluff, Arkansas ; P. S. BERG, Larimore, North Dakota ; E. W. MORRELL, Montpelier Seminary, Montpelier, Vermont ; A. P. READ, A. M., Clarence, Missouri ; and O. S. WESTCOTT, Principal North Chicago High School, Chicago.

Put $N=nD+1$, then it is evident that if $N=nD+1$ be raised to any positive integral power, the last term will be 1 and every other term will contain D as a factor ; hence if this power be divided by D the remainder will be 1.

Also solved in a similar way by A. H. BELL, JOSIAH H. DRUMMOND, ARTEMAS MARTIN and J. SCHEFFER.

III. Solution by J. O. MAHONEY, B. E., M. S., Graduate Fellow and Assistant in Mathematics, Vanderbilt University, Nashville, Tennessee.

If $a \equiv a'$, $b \equiv b'$, $c \equiv c'$, $d \equiv d'$, etc., mod(D),

then $abcd \dots \equiv a'b'c'd' \dots \text{mod}(D)$.

Let $a=b=c=d$, etc., $=N$, and $a'=b'=c'=d'$, etc., $=1$, then $N^k \equiv 1 \text{ mod}(D)$.

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

39. Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics, Columbian University, Washington, D. C.

A man is at the center of a circular desert ; he travels at a given rate but in a *perfectly* random manner. What is the probability that he will be off the desert in a given time?

No solution of this problem has been received.

40. Proposed by HENRY HEATON, M. Sc., Atlantic, Iowa.

If every point of an ellipse be joined with every other point, what is the average length of the chords thus drawn ?

Solution by the PROPOSER.

Let $a \cos \theta$ and $(b/a) \sin \theta$ be the coördinates of one point, and $a \cos \phi$ and $(b/a) \sin \phi$ those of another.

The length of the chord joining them is

$$K = [a^2 (\cos \phi - \cos \theta)^2 + \frac{b^2}{a^2} (\sin \phi - \sin \theta)^2]^{\frac{1}{2}}.$$

Let s_1 and s_2 = lengths of elliptic arcs from point $(a, 0)$ to points $(a \cos \theta, \frac{a}{b} \sin \theta)$ and $(a \cos \phi, \frac{a}{b} \sin \phi)$ respectively, and let S = whole distance around the ellipse.